APPENDIX 15.B - CHANNEL MITIGATION GEOMETRIES

15.B.1 INTRODUCTION

Where the disturbance of a channel is determined to be unavoidable, three alternatives shall be considered to maintain the channel's functional values:

- grade control structures,
- fish habitat structures, and
- bendway bank protection.

15.B.1.1 Grade Control Structures

Grade control structures similar to those shown on Figures 15.B-1 and 15.B-2 may be used to establish stable channel profile slopes. They are not acceptable where fish passage is a design criteria because they do not provide a pool from which the fish can jump to ascend upstream.

A grade control structure similar to Figure 15.B-3 may be used to establish a stable channel where fish passage is required. The length, L1, must be:

- equal to the distance the design fish can swim at its darting speed; or
- boulders must be embedded immediately upstream and downstream of the structure to provide resting areas;
- the channel flow depth and velocity during fish migration periods must be compatible with the design fish's darting swimming speed; and
- the overflow velocity must be compatible with the bust velocity.

The preferred type of grade control structure that is compatible with fish movement is similar to that shown in Figure 15.B-4.

Grade control may be also accomplished by using a culvert placed on a grade steeper than the modified or unstable channel. However, where fish passage is important, the culvert geometry must be determined using those procedures and criteria provided under Fishway Types.

Fish Habitat Structures

Figure 15.B-5 shows instream and riparian cover alternatives. Riparian fish cover facilities constructed of commercial products are shown in Figures 15.B-6 and 15.B-7. Two riparian facilities that also serve as bendway bank protection are shown on Figures 15.D-8 and 15.B-9. The commercial fish habitat alternatives shown in Figures 15.B-6 and 15.B-7 have yet to be tested. Limited use of the alternative shown in Figure 15.B-7 has revealed a tendency to fail during periods of high flow when the overhang sheet is displaced; covering the sheet with riprap or similar nonscourable material is recommended.

Non-Structural Bendway Bank Protection

Figures 15.B-8 and 15.B-9 illustrate how to provide more environmentally compatible bank protection in a bendway than that commonly associated with the protection provided by riparian spurs see the Bank Protection Chapter. These environmentally compatible devices are also useful in establishing a pool-riffle sequence.

Other criteria that shall be considered in providing stable banks for environmental channels is to:

- avoid neat line, trapezoidal shaped channels by using earth moving equipment to rough out near vertical banks for dominant (low-flow) channels to the approximate dimensions shown on the plans;
- install devices similar to that shown on Figures 15.B-8 and 15.B-9 as needed to protect bendways and provide meandering low-flow pattern for riffles and pools; and
- embed boulder(s) in the banks and revegetate the banks as shown on Figures 15.B-9 and 15.B-10.

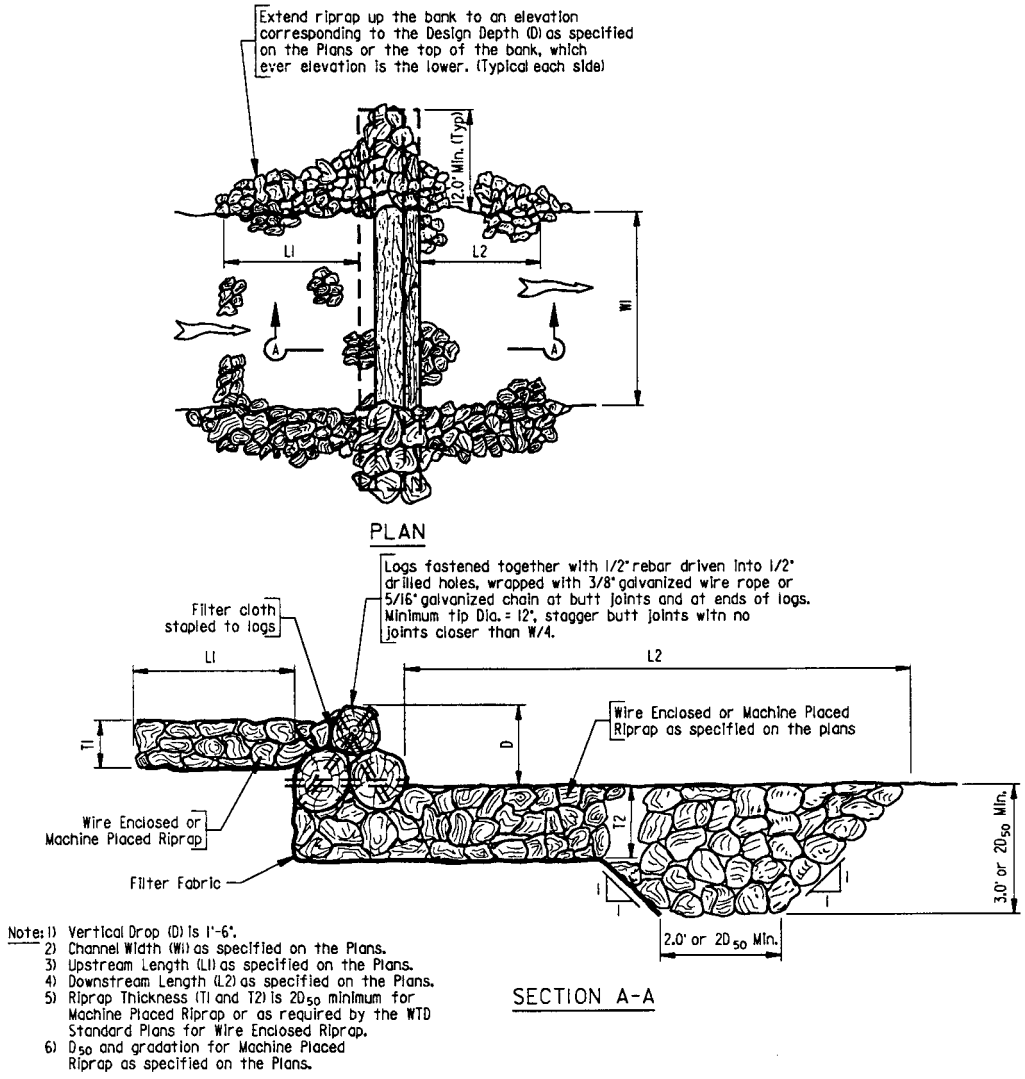
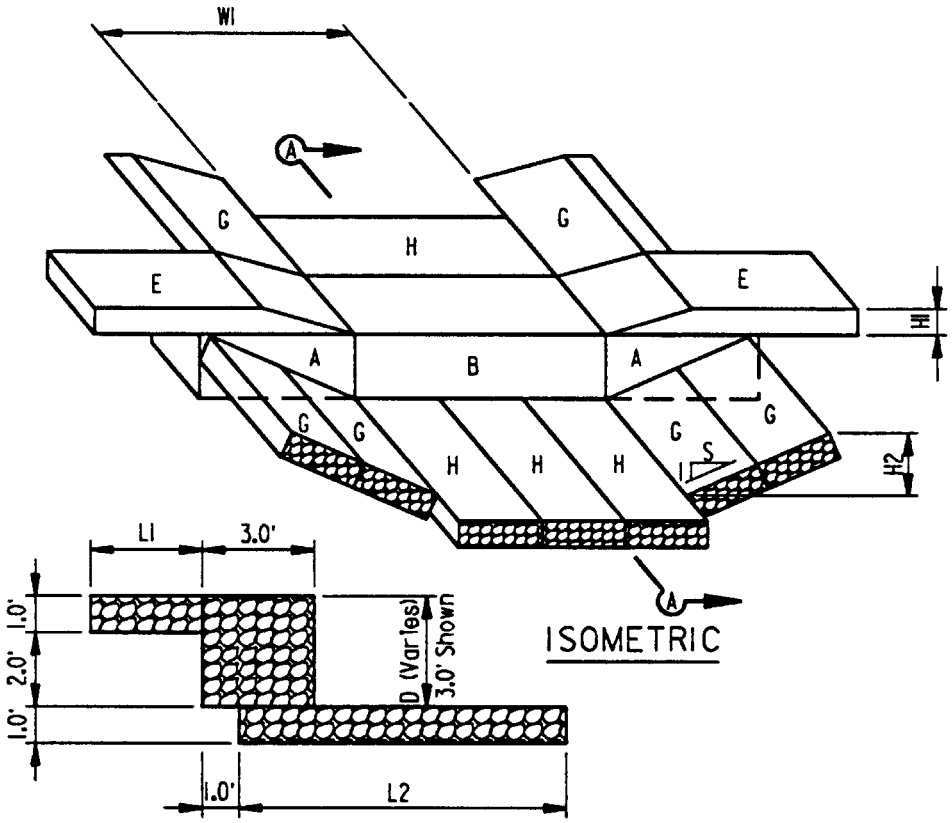


FIGURE 15.B-1 — Log Drop Grade Control Structure (Fishery Incompatible)



Note: 1) Vertical Drop (D) varies in increments of 3'-0":
3'-0" shown with one B basket.

2) Channel Width (WI) varies in increments of 3'-0":
9'-0" shown with three H baskets.

3) Upstream Length (LI) varies in increments of 3'=0":
3'-0" shown with one H basket.

4) Downstream Lenght (L2) varies in increments of 9'-0":
9'-0" shown with one H basket.

5) Upstream Depyh (HI) varies in increments of 1'-6":
1'-6" shown with one E and one G basket.

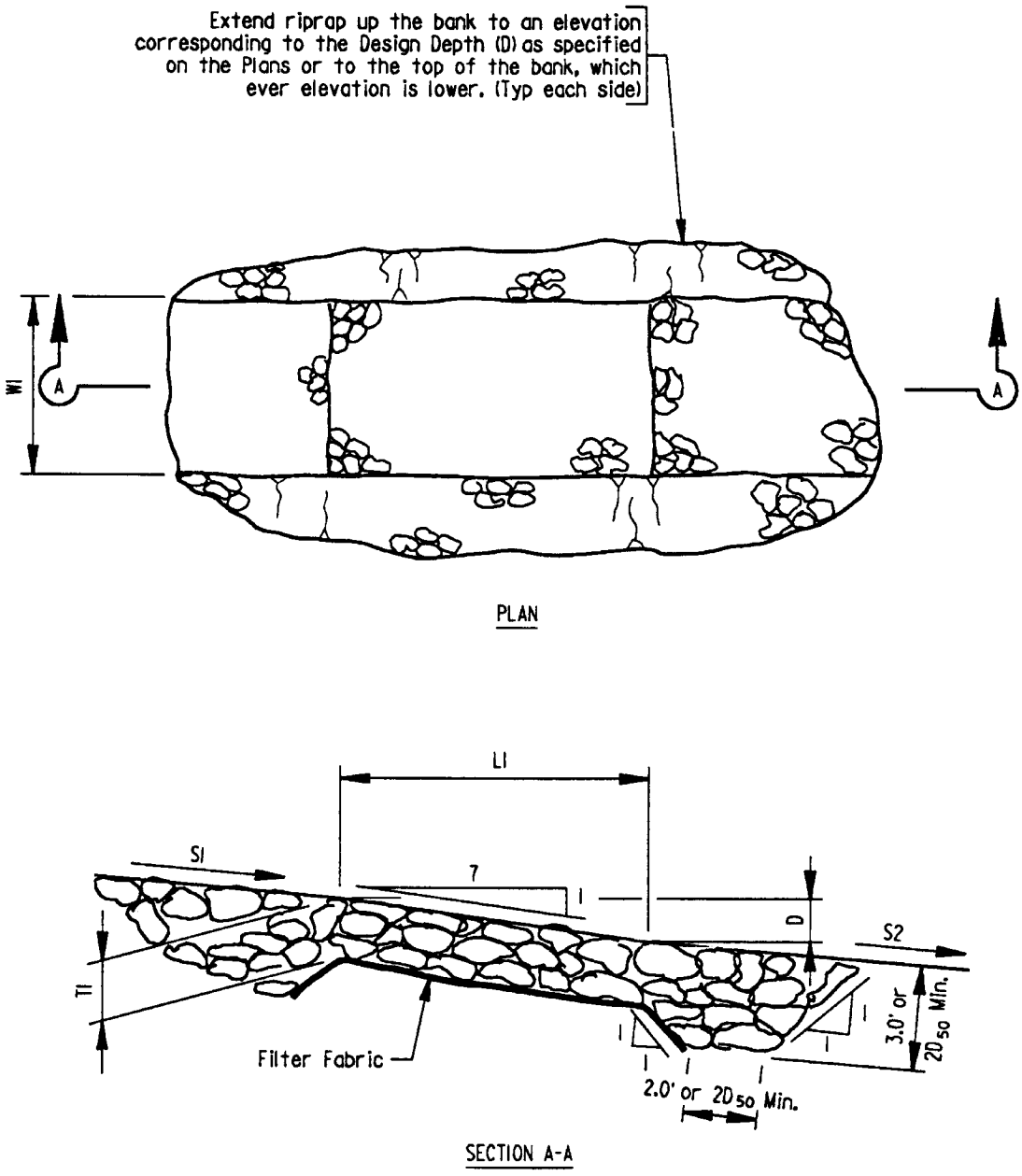
6) Downstream Depth (H2) varies in increments of N number of baskets as $NWI=\sqrt{1+S^2}$ in feet : $2WI=\sqrt{1+S^2}$ shown with two G baskets.

7) Channel Width (WI) as specified on the Plans.

8) Baskets to be provided and installed to conform to the D, WI, HI, LI and L2 dimensions as specified on the Plans.

BASKET DIMENSIONS			
Letter	Length, L-ft.	Width, W-ft.	Depth, D-ft.
A	6	3	3
B	9	3	3
E	9	3	1.5
G	6	3	1
H	9	3	1

FIGURE 15.B-2 — Wire Enclosed Rock Grade Control (Fishway Incompatible)



Note: 1) Vertical Drop (D) varies as specified on the Plans.
2) Channel Width (WI) as specified on the Plans.
3) Drop Length (LI) varies by 7D in feet.
4) Riprap Thickness (TI) is 2.0' or $2D_{50}$ minimum for Machine Placed Riprap and gradation or as specified by the Standards for Wire Enclosed Riprap.
5) Channel Slope (SI and S2) as specified on the Plans.
6) Toe details typical for upstream end as shown.

FIGURE 15.B-3 — Grade Control Structure (Marginal Fishway Compatible)

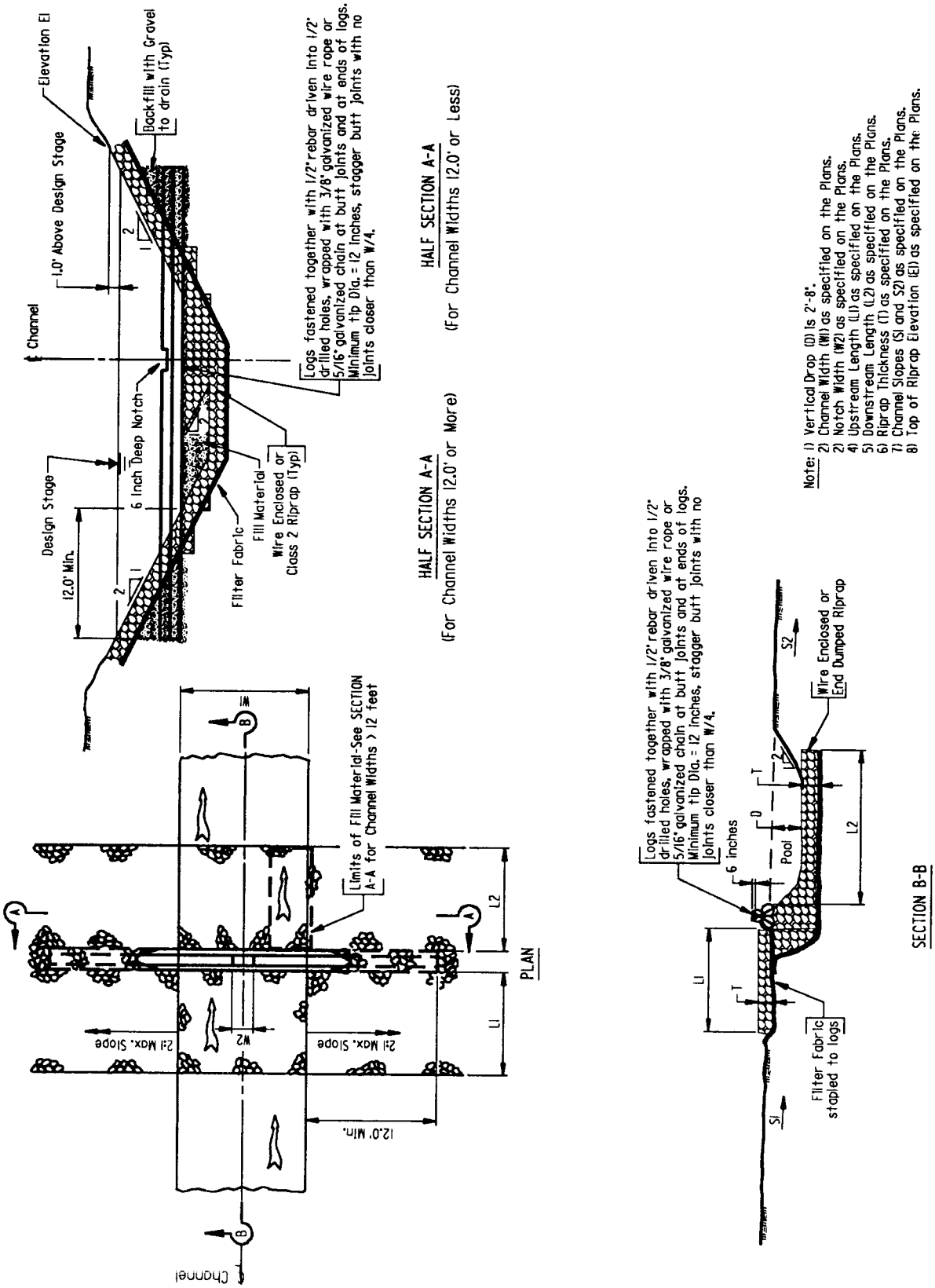


FIGURE 15.B-4 — Log Drop Grade Control Structure (Fishway Compatible)

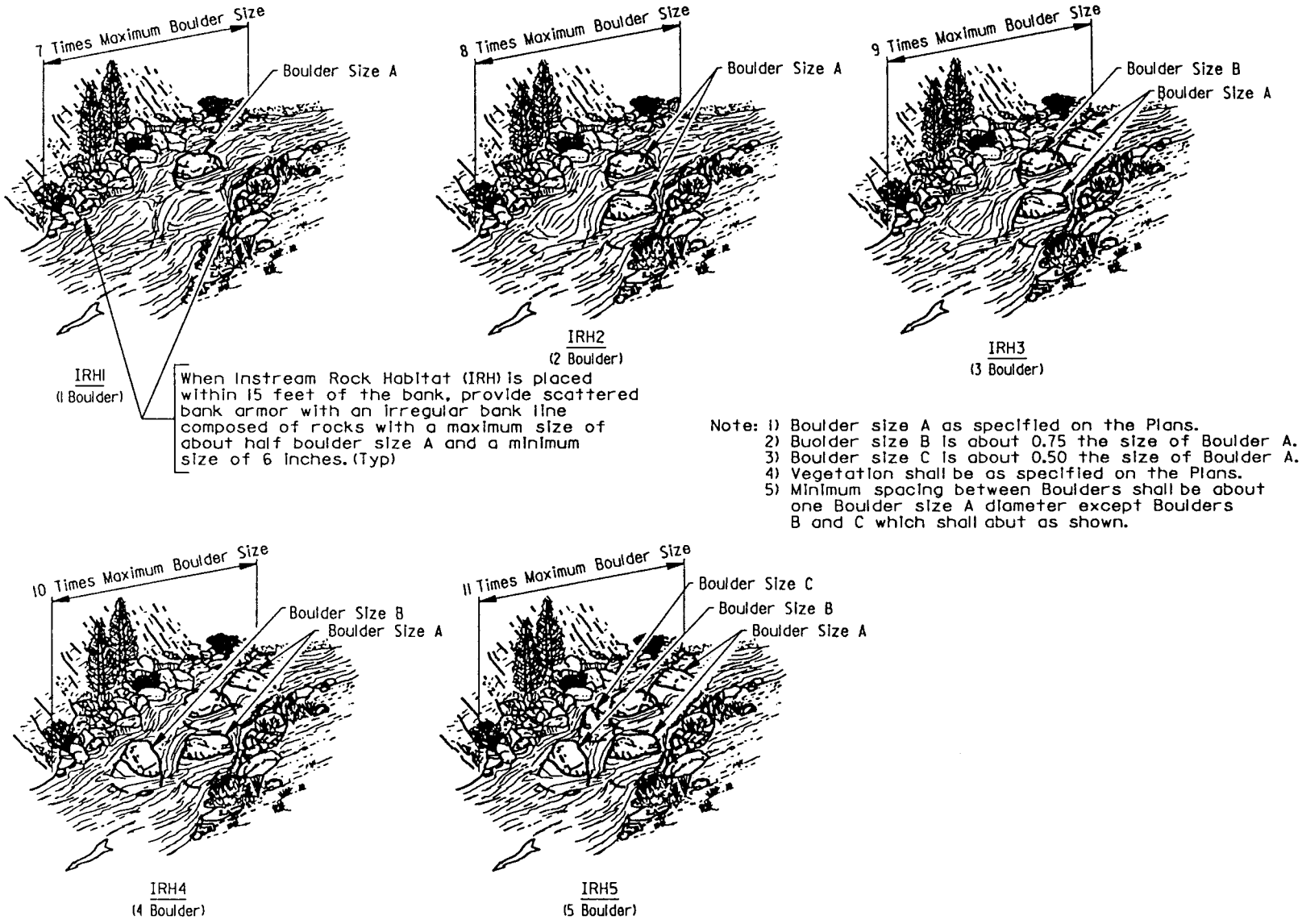


FIGURE 15.B-5 — Instream Rock Habitat

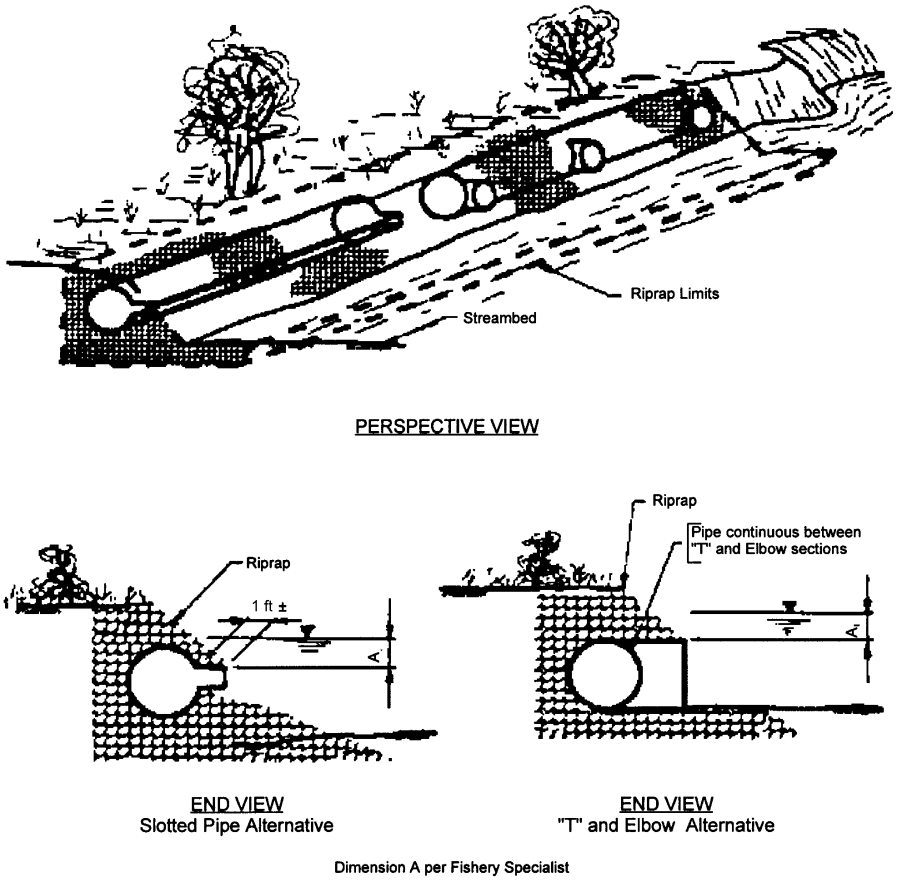


FIGURE 15.B-6— Riparian Fish Habitat (Slotted Drain Type)

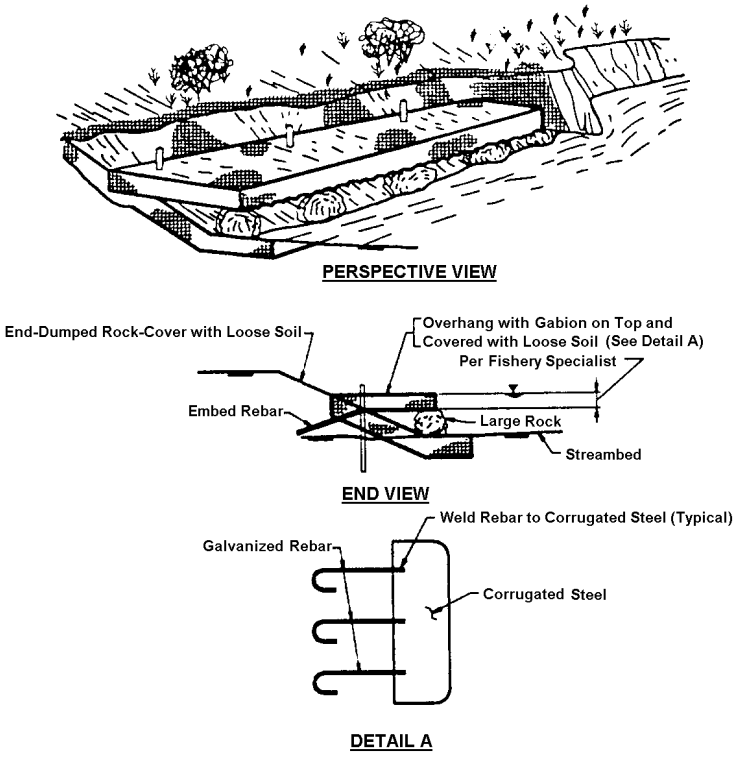


FIGURE 15.B-7 — Riparian Fish Habitat (Overhanging Bank Type)

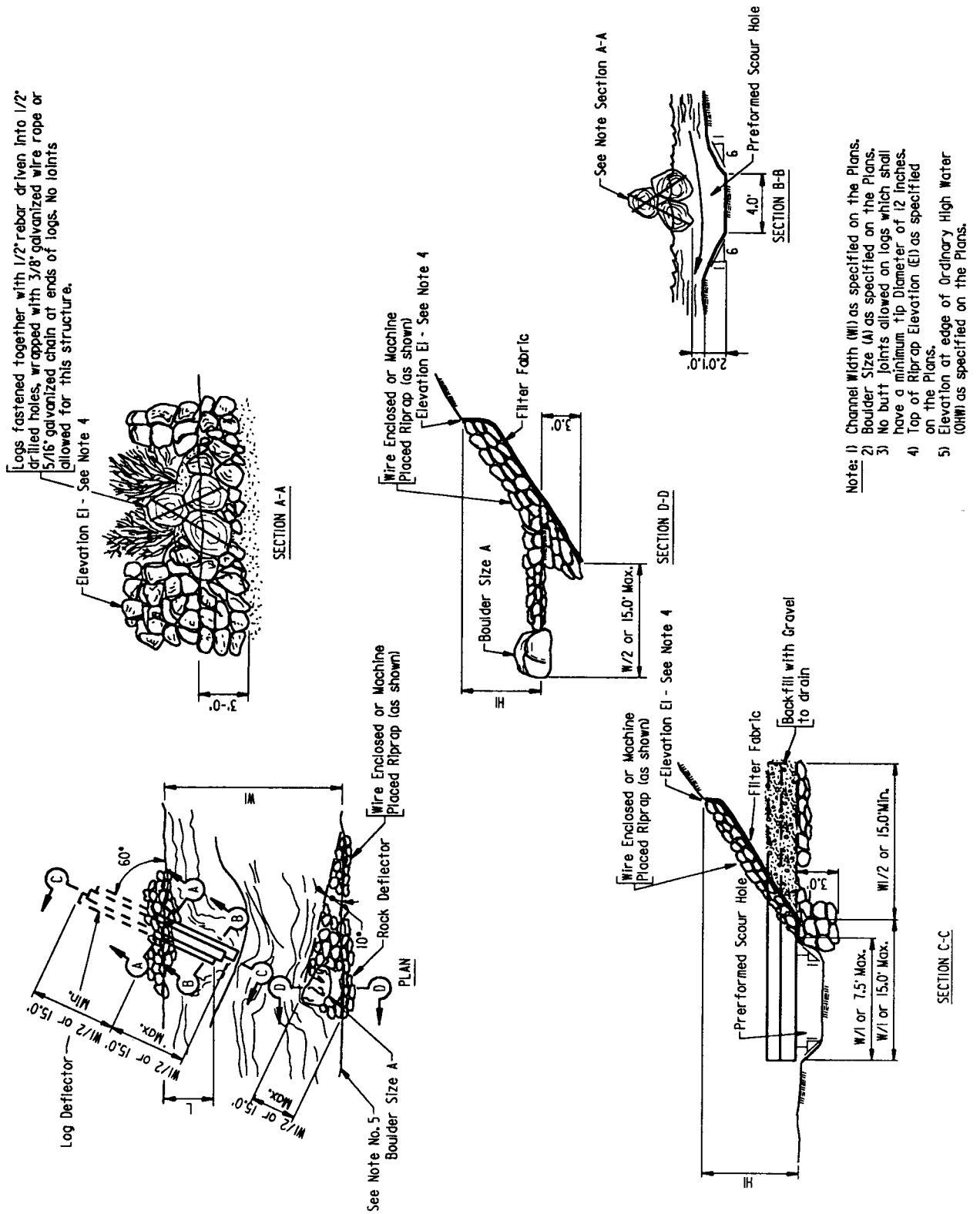


FIGURE 15.D-8— Bank Deflector Structure (Log Type)

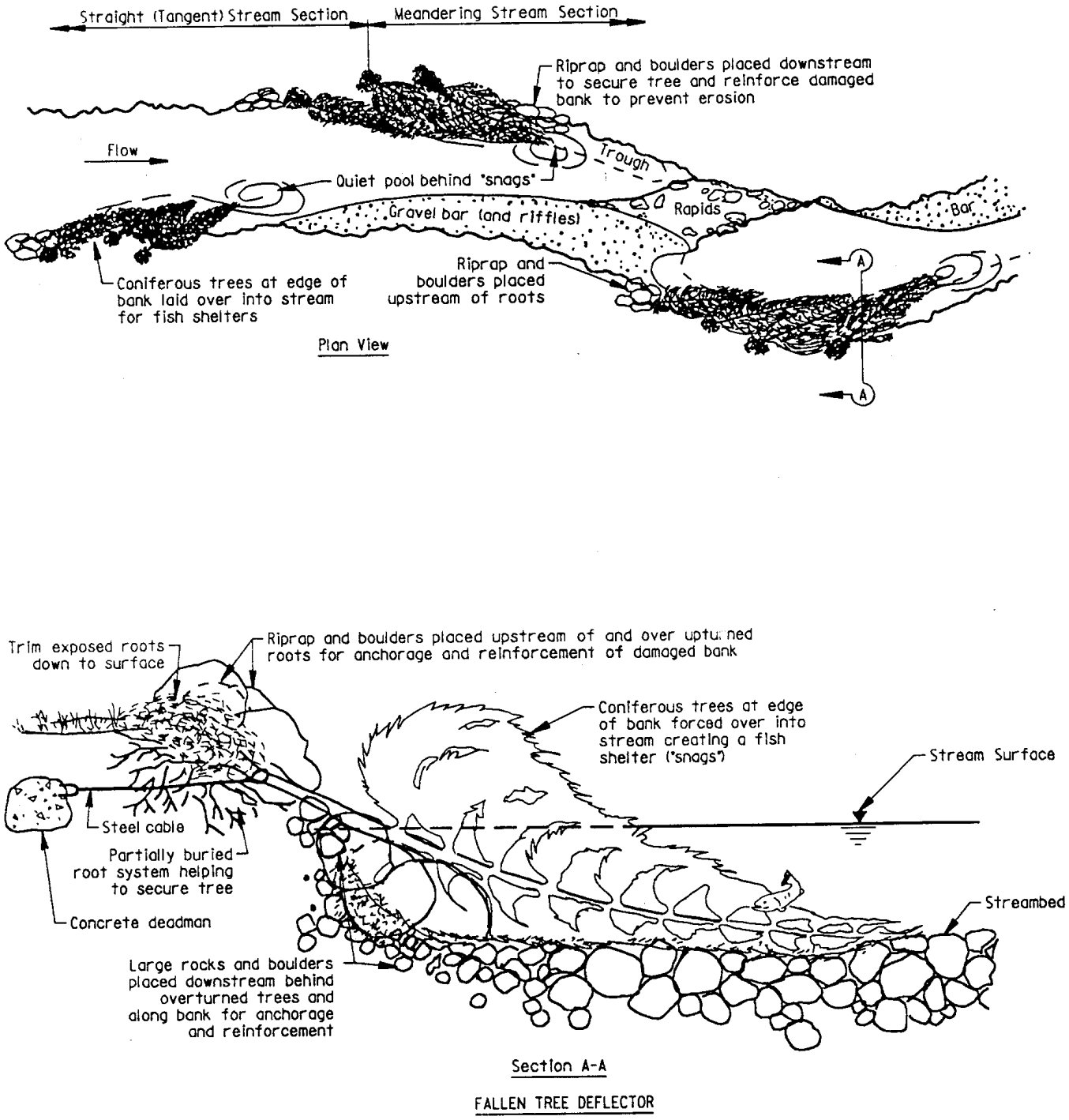


FIGURE 15.B-9 — Bank Deflector Structure (Cabled Tree Type)

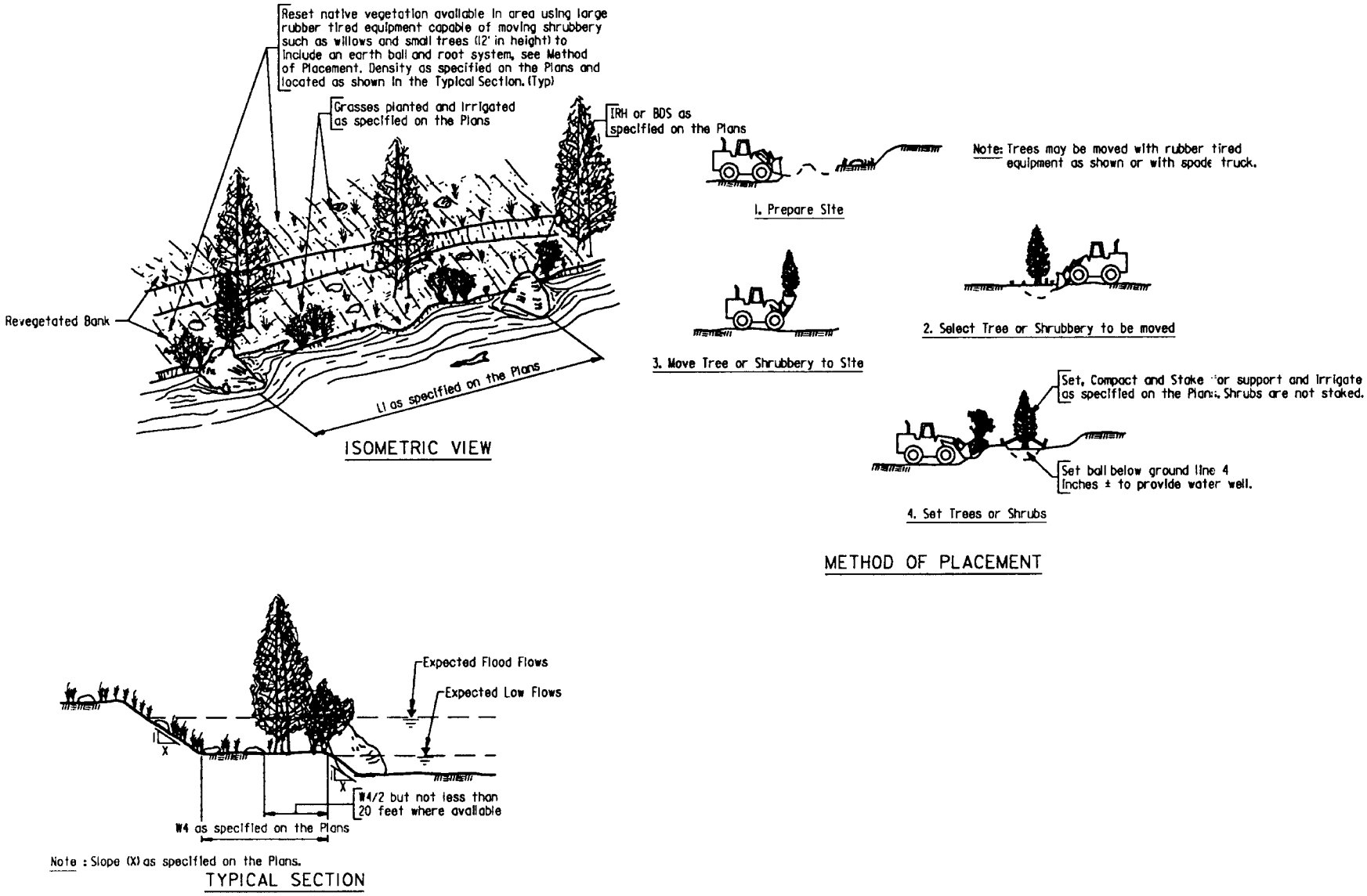


FIGURE 15.B-10 — Revegetated Banks and Selected Bank Armor